2.0 BACKGROUND

Hatcheries have been used for more than 100 years in an effort to increase salmon production and help mitigate the effects of human activities on salmon. At first, the "side-effects" or potential problems posed by hatchery programs were not recognized or well understood, and experts did not believe that there was any limit to the capacity of marine and freshwater habitats to provide the necessary resources for salmon growth and survival (NRC 1998). Not until the late 1930s were the life cycle of salmon and their predilection to return to their natal streams to spawn accepted as mechanisms for development and maintenance of a meta-population structure comprising many populations adapted to local environmental conditions (Lichatowich 1999). Without this knowledge, hatchery managers freely engaged in the interbasin and even interstate transfer of eggs and fish in order to maximize hatchery production, while the concomitant adverse effects of those transfers on wild population diversity, integrity, and productivity went unnoticed. These damaging practices continued well into the 20th century, even as scientists began to understand the implications for wild salmon.

Today, hundreds of artificial propagation programs operate to produce Pacific salmon, primarily as compensation for the impacts of development projects, but increasingly, to help avoid the complete disappearance of these fish from vast areas of their historical range (Table 2.1). In many cases, hatchery fish are all or most of what is left of a resource that Native American Tribes and others have depend on for generations.

Table 2.1. Artificial propagation programs in different areas of the Pacific Northwest and the total number of Pacific salmon programmed for release in those areas for 2002.

Region	Total Number Of Programs	Conservation Programs	Harvest Programs	Pacific Salmon Programmed for release in millions
Puget Sound Hood Canal & Ozette lake	126	21	105	130.2
Lower Columbia	95	3	92	72.6
Willamette River	16	0	16	7.5
Middle Columbia	21	0	21	40.3
Upper Columbia	24	5	19	9.9
Snake River	36	4	32	36.6
Oregon Coast	48	0	48	6.8

Depending upon management practices and the extent to which local natural fish are used for broodstock, hatchery programs may be either isolated from, or integrated with, local natural populations. Although every program is unique in some way, primarily because of the conditions and circumstances unique to their situation, hatchery programs generally have either or both of two basic goals: (1) to produce fish for harvest (including mitigation for lost production due to habitat loss or degradation); and (2) to help recover or conserve natural populations.

Only integrated propagation programs can potentially contribute to population viability and improve the biological status of an ESU. Integrated hatchery programs use local fish for broodstock (natural-origin and hatchery-origin fish included in the ESU), follow “best management practices” or BMPs and are designed around natural evolutionary processes that promote population viability. They have the potential to boost total (hatchery-origin and natural-origin fish) abundance and natural-origin fish abundance, particularly in the short term; however, their contribution over the long term is uncertain. Long-term reliance on these programs, without addressing the habitat or other factors limiting the natural populations, is of little value.

Integrated hatchery programs often have higher per capita population growth rates than natural populations. In part due to their short track record, there is little direct information available regarding the effects of integrated hatcheries on natural population growth rates or on an ESU’s overall productivity. Conceptually, integrated hatchery programs are unlikely to improve natural population growth rates except in cases where the natural population's small size is, in itself, a predominant factor limiting population growth. There is little information available to predict the contribution of artificial propagation to the productivity of an ESU in-total.

Well designed and implemented integrated hatchery programs have the potential to help preserve an ESU’s diversity over the short term For example, programs can temporarily support natural populations that might otherwise be extirpated or suffer severe bottlenecks. Hatchery programs also have the potential to increase the genetically effective size of small natural populations, although this must done with care to avoid adverse genetic effects.

Integrated hatchery programs that adhere to BMPs and reintroduce fish into streams and watersheds in which natural populations have been extirpated may improve an ESU’s spatial structure. When populations are depressed, the remaining individuals occupy the most desirable habitats, resulting in a reduced spatial distribution. Conceptually, an increase in abundance due to artificial propagation supplementation could result in the expansion of natural populations back into the less populated habitats, producing a beneficial increase in an ESU’s spatial structure and population connectivity. Integrated hatchery programs following BMPs also have the potential to improve spatial structure by maintaining populations in streams while conservation efforts restore essential habitats elsewhere. More broadly, propagation programs can play a role in "spreading the risk" by maintaining some populations in artificial environments as a hedge against catastrophic natural events. All programs have the potential to disrupt an ESU’s spatial structure, e.g., by using weirs that impede access to habitat.

Harvest augmentation and conservation goals are not automatically mutually exclusive. Integrated propagation programs are capable of producing more fish than can be immediately useful in the conservation and recovery of an ESU and can play an important role in fulfilling trust and treaty obligations and in supporting recreational and commercial fishing. In situations involving Pacific salmon protected under the ESA, NOAA Fisheries will continue to exercise its authority under Section 4(d) of the ESA to allow the harvest of listed hatchery-origin fish that are surplus to the conservation and recovery needs of an ESU in accordance with approved harvest plans (NMFS 2004d).

Numerous high-profile scientific panels have concluded that artificial propagation can potentially benefit or decrease the viability of salmonid populations (e.g., ISAB 2003, IMST 2001, ISAB 2001, HSRG 2000). Past hatchery strategies and practices have posed threats to natural populations. The rapidly evolving hatchery system is reducing these threats and is playing an important role in salmon recovery, by preserving genetic resources and by at least temporarily boosting the abundance of populations that have been severely impacted by habitat degradation or fishing. Managers are also turning to propagation programs for help in rebuilding abundance and in maintaining ESU spatial structure and genetic diversity. There remains considerable uncertainty, however, regarding the relative likelihood and magnitude of risks and benefits from artificial propagation. Another potential consequence of hatchery production is the effect of "mixed-stock harvest" on fish that are intended to escape to the spawning grounds. If abundance-based harvest limits are based on total run sizes (hatchery-origin and natural-origin fish together), the result can be harvest rates on fish intended to spawn naturally that are higher than might otherwise be allowed if they were based only on weak natural populations. Nonetheless, the clear and unavoidable conclusion from the various scientific panels is that, in order to assure the long-term persistence of salmon, it will be necessary to institute habitat, hydrosystem management, and harvest reforms to create or conserve ecosystem conditions that allow for viable, naturally spawning salmonid populations.